Navy Clothing & Textile Research Facility

First Attack Fire Suit

508-233-4189
nctrf@nctrf.natick.army.mil

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First Attack Fire Suit

Objectives

With the advent of reduced manning, it is necessary to develop a lightweight fire garment which can be easily deployed throughout the ship

Approach

- Investigate / engineer unique materials for suit (non conventional)
- Design suit that can be easily and quickly donned
- Develop prototypes and evaluate using instrumented manikins and during live fire fighting

Material Concepts

Outershells

- Aluminized materials
- Knit materials – three end knit fleeces
- Conventional woven materials less than 6.0 oz per sq yd

Thermal Liners

- Conventional batts – different thicknesses
- Three D textiles – spacer materials

Barriers

- NFPA approved materials only

Design Concept

Conceptual Design

- One piece pullover coverall
- Elastic waist / cuffs / ankles
- Sewn on hood
- Inseam single zipper

Inseam zipper for entry

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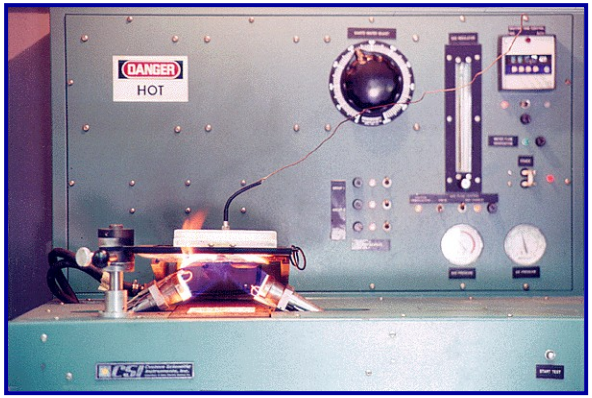
Thermal Testing



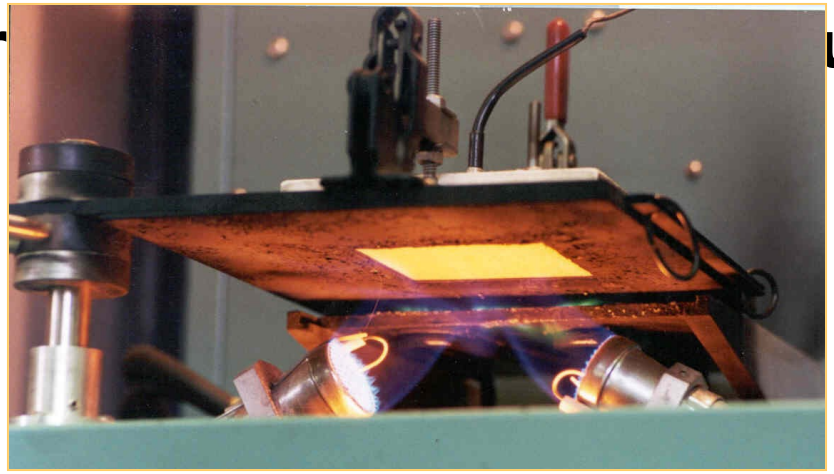
Thermal Protective Performance Tester

Convective Oven

Dynamic Full Scale Flame Chamber

Thermal Protective Performance Tester

- **Evaluate overall TPP of system**
- **Strength after heat exposure**
  - **TPP for 17.5 sec with a ball burst str ure**



Testing

Convective Oven

- **Evaluate fire suit on an instrumented manikin in a thermal environment for burn injury**
- **Temperature of the oven is 285º F**

Testing

Dynamic Full Scale Fire Chamber

- **Evaluate fire suit on instrumented manikin for burn injury 4 ft from the fire and moving through the fire**
- **Temperature of fire 2000º F**

Testing

Live Fire Testing_

- Navy's fire test ship EX-USS Shadwell
- Damage Control Fire personnel perform actual fire fighting

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Materials Selected

Outershell

- **Aluminized material offered high radiant protection but lower convective heat protection and for this reason rejected**
- **Knit material offered extremely high thermal protection but knit durability was extremely low and for this reason rejected**
- **Woven material was lighter weight, higher durability (abrasion), higher strength after heat exposure and for these reasons selected**

Materials Selected

Lining Systems_

- **Spacer materials offered high thermal protection when in natural uncompressed state, lower thermal protection in compressed state, high cost associated with this material, material rejected**
- **Batting with comfort filament face cloth was selected. The batting is 1/3 lighter then currently used in the Navy's Fire Protective Garment**

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Comparison Qualities

	Navy Fire Suit	First Attack
Weight	8.5 lbs	5.5 lbs
TPP	40 tpp	31.5 tpp
Strength/heat exp.		6x greater
Dynamic fire test		results equal
Convective heat test		TBT
Shadwell testing		
Comfort		better
Protection		no noticeable difference
Sizing	18 sizes	2 sizes
Cost		$400 less

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Final Design

- Pullover style
- Detachable zipper hood
- Front pocket is storage pouch
- Two inch length take up straps
- Over the thumb wristlets
- Single outseam zipper